



NSRL-07B RUN

May - June 2007

FINAL REPORT

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<http://www.bnl.gov/medical/NASA>

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EXECUTIVE SUMMARY

During the summer of 2007, a series of radiobiological and physics experiments were performed using the proton and heavy ion beams available at the NASA Space Radiation Laboratory (NSRL). These experiments were part of the thirteenth NSRL scientific run (NSRL-07B) sponsored by NASA's Space Radiation Health Program (SRHP) heavy ion radiobiology research program at BNL.

A total of thirty four proposals were approved and thirty two participated in the NSRL-07B run. One hundred and twenty four users from thirty institutions were represented, twenty eight from the United States, and two foreign institutions. More than 2000 biological samples were exposed at the NSRL beam line, employing 177:55 hours of beam time for science (24:07 hours for in vivo studies, 110:13 hours for in vitro studies, 0:35 hours for plant studies, and 42:59 hours for physics experiments) delivered in a six week period. In addition, 5:58 hours were used for dosimetry and beam development. Machine set-up took a total of 52:00 hours, and 13:00 hours for wrap-up of the beam. Accelerator problems with the NSRL beam accounted for 16:17 hours lost. This gave a total NSRL usage time of 265:10 hours. In addition to the NSRL beam time, there were 51:14 hours during which operations at NSRL were suspended while waiting for RHIC to fill, or waiting for RHIC to resolve problems that were specific to RHIC. These hours are recorded for informational purposes only.

During NSRL-07B, Booster provided iron (600 and 1000 MeV/nucleon), protons (250, 500, 1000, 1200 and 2000 MeV/n), and titanium (1000 MeV/n) beams for biology and physics experiments. The maximum dose rates used for biology experiments were as high as 10 Gy/min (Fe 600 MeV/n). The general spill rate employed was 15 spills per minute with durations of approximately 300 msec/spill. The spill fluence range was (particles/spill) from 1.5×10^{11} (max) and 2×10^2 (min). Square beam spots as big as $20 \times 20 \text{ cm}^2$ and as small as $1 \times 1 \text{ cm}^2$ were employed for biology and physics experiments.

Since NSRL 07B followed immediately on the completion of NSRL 07A, there was no specific Tandem-Booster set-up required. A 1000 MeV proton beam was tuned into the target cave on 22 May 2007 at 7:00 AM. NSRL 07B officially ended at 1:20 PM 29 June 2007.

Projects Reviewed by the BNL Scientific Advisory Committee in Radiobiology

Exp.	Participant	Sponsor	NSRL Participation
B-44	Durante, Marco	ASI	Yes
B-52	Gewirtz, Alan†	NSBRI	Yes
N-88	Sutherland, Betsy	NASA	Yes
N-89	Held, Kathy	NASA	Yes
N-97	Kronenberg, Amy	NASA	Yes
N-99	Zhao, Yongliang	NASA	Yes
N-102	Hall, Eric	NASA	No
N-104	Ullrich, Robert	NASA	No
N-120	Redpath, J.L.	DOE/NASA	Yes
N-128	Blakely, Eleanor	NASA	Yes
N-129	Limoli, Charles	NASA	Yes
N-134	Chen, David	NASA	Yes
N-135	Pluth, Janice	NASA	Yes
N-145	O'Banion, M. Kerry	NASA	Yes
N-154	Maurer, Richard	NASA/NSBRI	Yes
N-157	Schiestl, Robert	NASA	No
N-159	Hall, Eric†	NASA	Yes
N-160	Spence, Harlan	NASA-ESMD	Yes
N-167	Burma, Sandeep	NASA	Yes
N-170	Wang, Ya	DOE/NASA	Yes
N-172	Berkowitz, Daniel	NASA	Yes
N-175	Fike, John	DOE NASA-NSCOR	No
N-176	Cucinotta, Francis	DOE/NASA	Yes
N-177	Morgan, William†	NASA	Yes
N-185	Sutherland, Betsy	DOE-NASA	Yes
N-186	Shay, Jerry	NASA	Yes
N-189	Britt, Ann	DOE-BES	Yes
N-196	Azzam, Edouard	NASA	Yes
N-197	Fornace, Jr., Al	NASA	Yes
N-199	Ware, Jeffrey	NASA	Yes
E-2	Braby, Les	NASA	No
E-4	Hassler, Donald	NASA ESMD	Yes
E-6	Benton, Eric	SHOT Inc.	Yes
E-7	Jones, James	Idaho National Lab	Yes

†Not Present During Actual Run

PARTICIPANTS (Principal Investigators are highlighted)

Exp.	Participant	Affiliation	Guest Title
B-44	Durante, Marco	Universita di Napoli	Guest Scientist
	Belluco, Maurizio	Alcatel-Alenia Space	Guest Scientific Associate
	Bertucci, Antonella	Universita di Napoli	Guest Research Assistant
	Van Baalen, Mary	NASA - Johnson Space Center	Guest Research Assistant
B-52	Gewirtz, Alan†	University of Pennsylvania	Guest Scientist
N-88	Sutherland, Betsy	Brookhaven National Laboratory	Scientist
N-89	Held, Kathy	Massachusetts General Hospital	Guest Scientist
	Han, Wei	Massachusetts General Hospital	Guest Jr Research Associate
	Purschke, Martin	Massachusetts General Hospital	Guest Research Associate
	Spantchak, Yulya	Massachusetts General Hospital	Guest Scientific Associate
	Yang, Hongying	Massachusetts General Hospital	Guest Research Associate
N-97	Kronenberg, Amy	Lawrence Berkeley National Laboratory	Guest Scientist
	Dan, Cristian	Oregon Health & Science University	Guest Scientific Associate
	Turker, Mitchell	Oregon Health & Science University	Guest Scientist
	Barcellos-Hoff, Mary Helen	Lawrence Berkeley National Laboratory	Guest Scientist
N-99	Zhao, Yongliang	Columbia University	Guest Jr Research Associate
N-102	Hall, Eric†	Columbia University	Guest Scientist
N-104	Ullrich, Robert	Colorado State University	Guest Scientist
N-120	Redpath, J.L.	University of California @ Irvine	Guest Scientist
	Elmore, Eugene	University of California @ Irvine	Guest Scientist
N-128	Blakely, Eleanor	Lawrence Berkeley National Laboratory	Guest Scientist
	Arrichiello, Cecilia	Universita di Napoli	Guest Scientific Associate
	Aypar, Umut	University of Maryland	Guest Research Assistant
	Belov, Oleg	Joint Institute for Nuclear Research (JINR)	Guest Research Assistant
	Borak, Thomas B	Colorado State University	Guest Scientist
	Colindres, Miriam	University of Mainz	Guest Research Assistant
	Dartnell, Lewis	University of London	Guest Research Assistant
	Doursout, Marie-Francoise	University of Texas @ Houston	Guest Scientist
	Gonzalez, Oscar	University of Texas Southwestern	Guest Research Assistant
	Hellweg, Christine	German Aerospace Centre	Guest Scientist
	Khaled, Saman	University of Alabama	Guest Jr Research Associate
	Lacy, Shareen	Universities Space Research Association	Guest Scientific Associate
	Li, Yijun	University of Maryland	Guest Research Associate

Exp.	Participant	Affiliation	Guest Title
N-128	Mezentsev, Alexandre	Columbia University	Guest Scientist
	Nie, Ying	Loma Linda University	Guest Scientist
	Plante, Ianik	University of Sherbrooke	Guest Research Associate
	Shay, Jerry	University of Texas Southwestern	Guest Scientist
	Szolc-Kowalska, Barbara	Northwestern University	Guest Scientist
	Townsend, Lawrence	University of Tennessee	Guest Scientist
	Wang, Minli	University of Duisberg School of Medicine	Guest Research Associate
	Nelson, Gregory	Loma Linda University Medical Center	Guest Scientist
N-129	Limoli, Charles	University of California @ Irvine	Guest Scientist
	Giedzinski, Erich	University of California @ Irvine	Guest Scientific Associate
	Izadi, Atefeh	University of California @ Irvine	Guest Scientific Associate
N-134	Chen, David	University of Texas Southwestern	Guest Scientist
	Story, Michael	University of Texas Southwestern	Guest Scientist
	Park, Seongmi	University of Texas Southwestern	Guest Research Associate
	Peyton, Michael	University of Texas Southwestern	Guest Scientist
N-135	Pluth, Janice	Lawrence Berkeley National Laboratory	Guest Scientist
	Whalen, Mary	Lawrence Berkeley National Laboratory	Guest Scientific Associate
N-145	O'Banion, M. Kerry	University of Rochester	Guest Scientist
	Hurley, Sean	University of Rochester	Guest Scientist
	Trojanczyk, Lee	University of Rochester	Guest Scientific Associate
	Williams, Jacqueline	University of Rochester	Guest Scientist
N-154	Maurer, Richard Hornsby	Johns Hopkins University	Guest Scientist
	Roth, David Richard	Johns Hopkins University	Guest Scientist
	Heilbronn, Lawrence Harvey	Lawrence Berkeley National Laboratory	Guest Scientist
	Zeitlin, Cary	Lawrence Berkeley National Laboratory	Guest Scientist
N-159	Hall, Eric†	Columbia University	Guest Scientist
N-160	Spence, Harlan	Boston University	Guest Scientist
	Foster, Richard	Massachusetts Institute of Technology	Guest Scientific Associate
	Kasper, Justin	Massachusetts Institute of Technology	Guest Scientist
	Mazur, Joseph	Aerospace Corporation	Guest Scientist
N-167	Burma, Sandeep	University of Texas Medical Branch	Guest Scientist
	Camacho, Cristel	University of Texas Southwestern	Guest Jr Research Associate
	Mukherjee, Bipasha	University of Texas Southwestern	Guest Scientist
N-170	Wang, Ya	Thomas Jefferson University	Guest Scientist
	Jang, Deok-Jin	Lawrence Berkeley National Laboratory	Guest Jr Research Associate

Exp.	Participant	Affiliation	Guest Title
N-170	Rydberg, Bjorn E.	Lawrence Berkeley National Laboratory	Guest Scientist
	Wang, Hongyan	Thomas Jefferson University	Guest Scientific Associate
N-172	Berkowitz, Dan	Johns Hopkins University	Guest Scientist
	Soucy, Kevin	Johns Hopkins University	Guest Jr Research Associate
N-176	Cucinotta, Francis A.	NASA - Johnson Space Center	Guest Scientist
	Anderson, Jennifer	Medical Research Council	Guest Scientific Associate
	George, Kerry Ann	Wyle Laboratories @ Houston	Guest Scientific Associate
	Huff, Janice	Universities Space Research Association	Guest Scientist
	O'Neill, Peter	Medical Research Council	Guest Scientist
N-177	Morgan, William†	University of Maryland	Guest Scientist
	Baulch, Janet	University of Maryland	Guest Scientist
	Dziegielewski, Jaroslaw	University of Maryland	Guest Research Associate
	Goetz, Wilfried	University of Maryland	Guest Scientific Associate
N-185	Sutherland, Betsy	Brookhaven National Laboratory	Scientist
N-186	Shay, Jerry	University of Texas Southwestern	Guest Scientist
	Delgado, Oliver	University of Texas Southwestern	Guest Jr Research Associate
	Roig, Andres	University of Texas Southwestern	Guest Jr Research Associate
N-189	Huefner, Neil	University of California @ Davis	Guest Jr Research Associate
N-191	Wang, Huichen	Temple University	Guest Scientist
N-196	Azzam, Edouard Iskandar	University of Medicine and Dentistry of NJ	Guest Scientist
	Autsavapromporn, Narongchai	University of Medicine and Dentistry of NJ	Guest Jr Research Associate
	Buonanno, Manuela	University of Medicine and Dentistry of NJ	Guest Research Assistant
	de Toledo, Sonia	University of Medicine and Dentistry of NJ	Guest Scientist
	Yang, Zhi	University of Medicine and Dentistry of NJ	Guest Research Associate
N-197	Fornace, Jr, Albert	Georgetown University	Guest Scientist
	Datta, Kamal	Georgetown University	Guest Research Associate
	Doiron, Kathryn	Georgetown University	Guest Scientific Associate
N-199	Ware, Jeffrey Hart	University of Pennsylvania	Guest Scientist
	Davis, James	University of Pennsylvania	Guest Scientist
	Wambi, Christel	University of Pennsylvania	Guest Research Associate
E-4	Hassler, Donald	Southwest Research Institute	Guest Scientist
	Bokman, Ryan	Southwest Research Institute	Guest Scientific Associate
	Kortmann, Onno	Christian-Albrechts	Guest Jr Research Associate
	Weigle, Gerald	Southwest Research Institute	Guest Jr Research Associate
E-6	Benton, Eric	Eril Research, Inc.	Guest Scientist

Exp.	Participant	Affiliation	Guest Title
E-7	Jones, James	Idaho National Laboratory	Guest Scientist
	Makela, Mark	Los Alamos National Laboratory	Guest Research Associate
	Murray, Mathew	Los Alamos National Laboratory	Guest Scientific Associate
NSRL(NASA)	Sulzman, Frank Michael	NASA - Johnson Space Center	Guest Scientist
NSRL	Guida Peter†	Brookhaven National Laboratory	Scientist
	Tafrov, Stefan†	Brookhaven National Laboratory	Associate Scientist
	Keszenman, Deborah†	Brookhaven National Laboratory	Associate Scientist
	Pyatt, Beatrice†	Brookhaven National Laboratory	Medical Associate
	Abele, William	Brookhaven National Laboratory	Associate Scientist
	Sutherland, John†	Brookhaven National Laboratory	Senior Scientist
	Bennett, Paula†	Brookhaven National Laboratory	Biology Associate I
	Trunk, John†	Brookhaven National Laboratory	Senior Technical Associate
	Hein, Patricia†	Brookhaven National Laboratory	Senior Administrative Assistant
	Kershaw, Maryann†	Brookhaven National Laboratory	BLAF Manager
	Jardine, James†	Brookhaven National Laboratory	Laboratory Specialist
	Sivertz, Michael†	Brookhaven National Laboratory	Scientist
	Naidu, Mamta†	Brookhaven National Laboratory	Associate Scientist
	Kim, Angela†	Brookhaven National Laboratory	Medical Associate
	Billups, Adele†	Brookhaven National Laboratory	Medical Associate
	Thompson, Laura†	Brookhaven National Laboratory	Medical Associate
	Rusek, Adam†	Brookhaven National Laboratory	Scientist

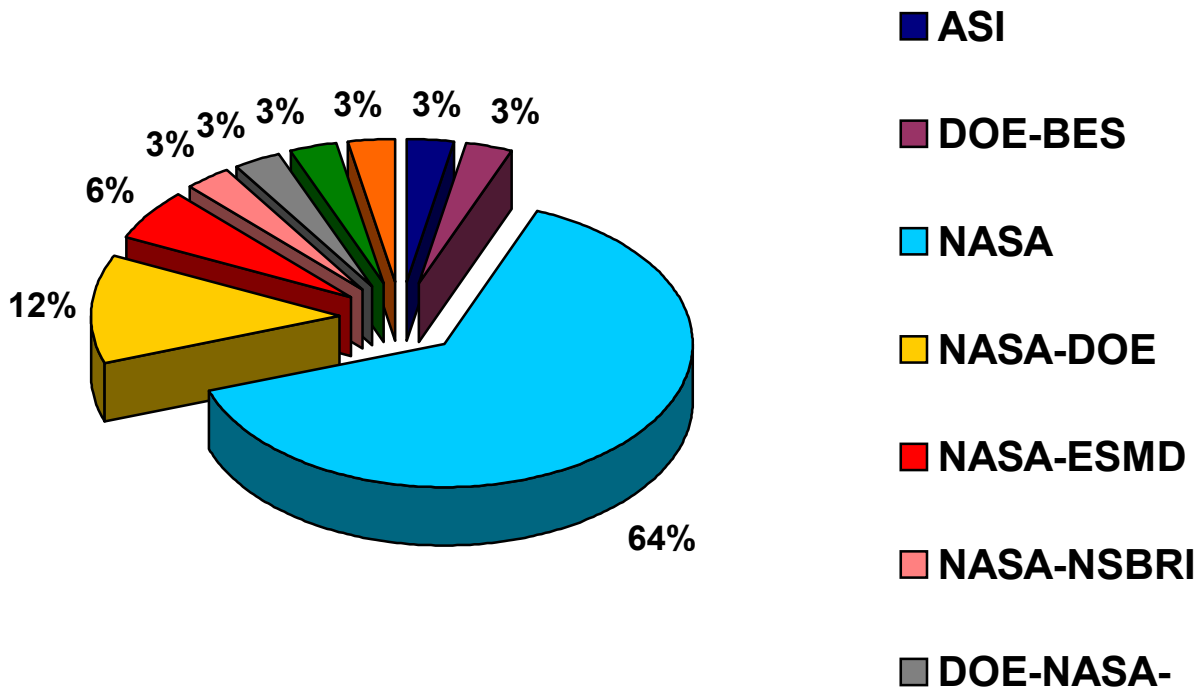
† Not present during actual run.

‡ BNL Personnel who participated in many different experiments throughout the run.

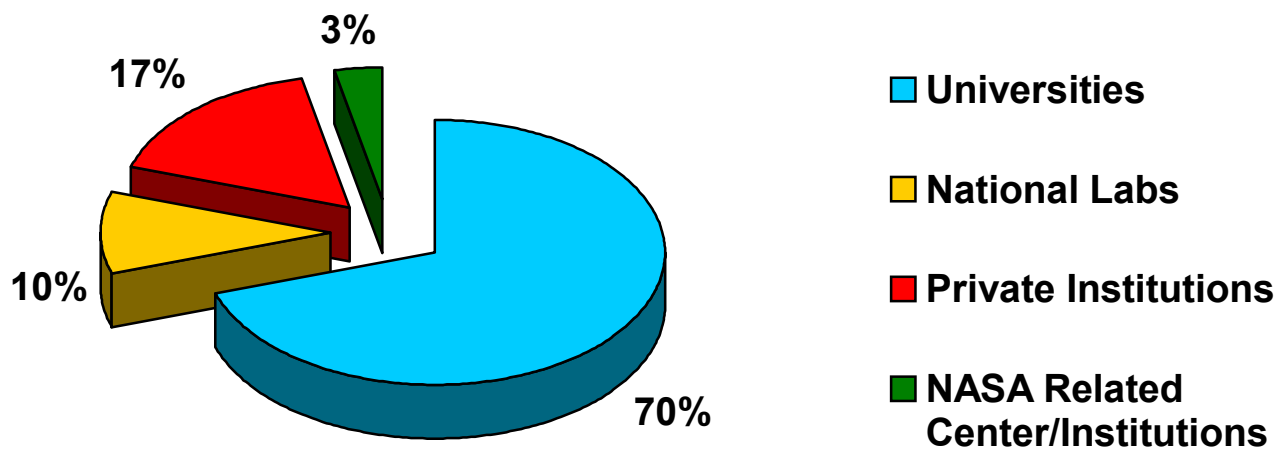
PARTICIPANT INSTITUTIONS

<u>Universities (21)</u>	<u>National Laboratories/Institutions (3)</u>
Boston University	Brookhaven National Laboratory
Colorado State University	Idaho National Laboratory
Columbia University	Lawrence Berkeley National Laboratory
Georgetown University	
Johns Hopkins University	
Johns Hopkins Applied Physics Laboratory	
Loma Linda University	<u>NASA Related Centers/Institutions (1)</u>
Massachusetts Institute of Technology	NASA - Johnson Space Center
Temple University	
Texas A&M University	
UC San Francisco	
UCLA Schools of Medicine and Public Health	
UMDNJ-New Jersey Medical School	<u>Private Institutions (5)</u>
United States Naval Academy	Alcatel-Alenia Space
University Federico II, Dipartimento di Scienze Fisiche	Eril Research
University of California @ Davis	Massachusetts General Hospital
University of California Irvine	Northrop Grumman Corp.
University of Maryland School of Medicine	Southwest Research Institute
University of Pennsylvania	
University of Rochester Medical Center	
University of Texas, Southwestern Medical Center at Dallas	

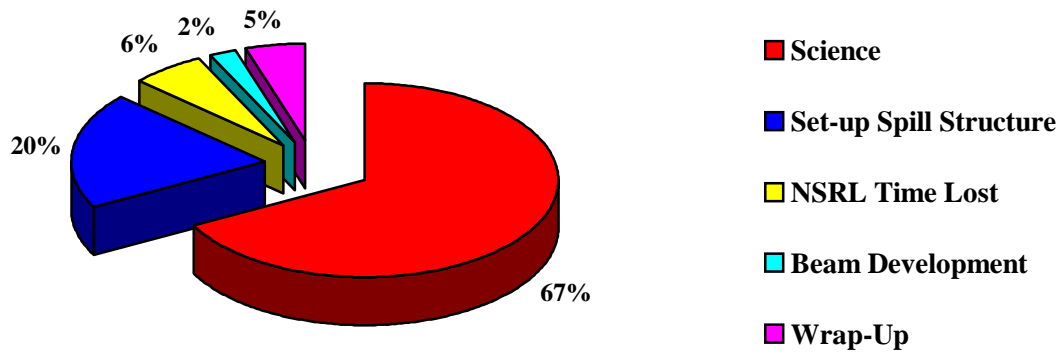
RESEARCH PROJECT SPONSORS



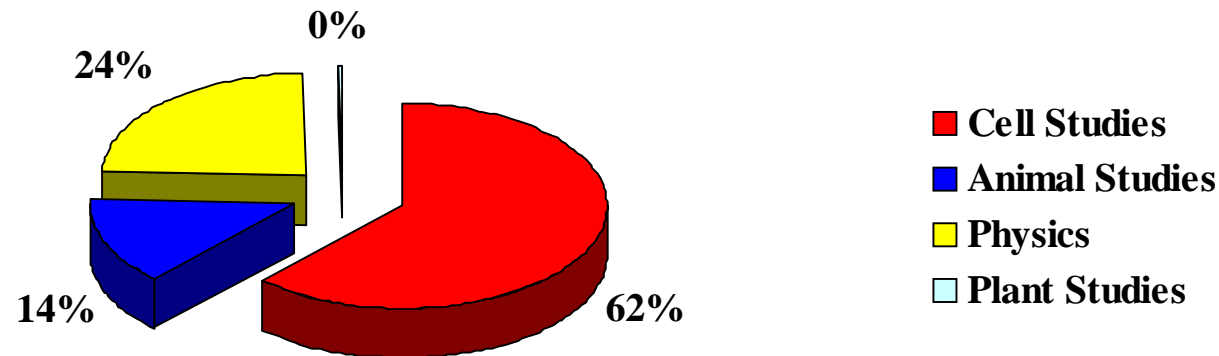
INSTITUTION STATISTICS



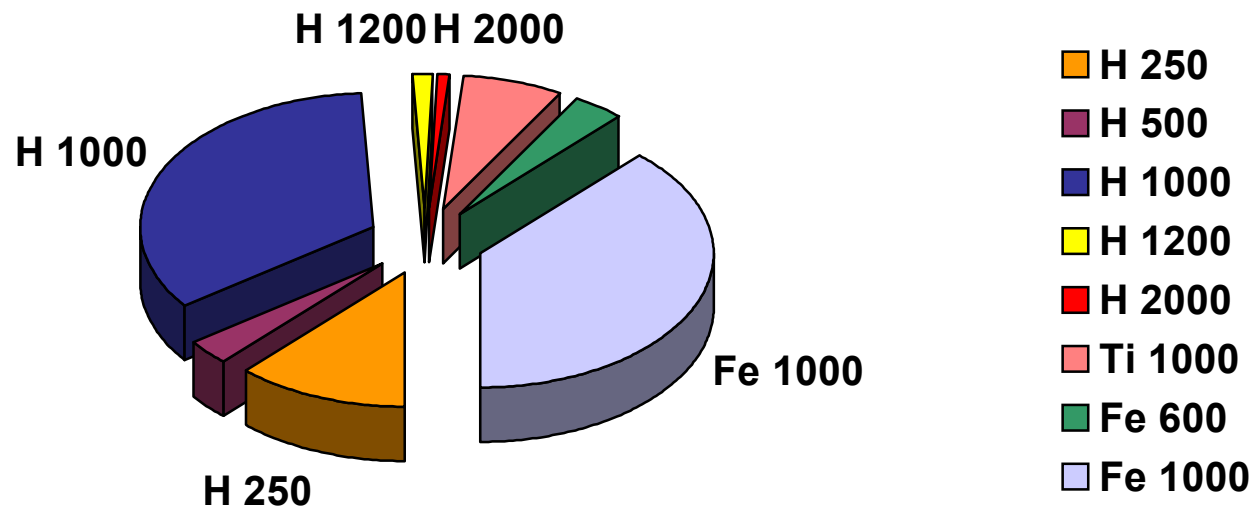
TOTAL RUN-TIME STATISTICS



SCIENCE STUDIES STATISTICS



ION SPECIES AND ENERGY (MeV/n) DISTRIBUTION



RUN TIME DESCRIPTION (hours)

NSRL-07B	ION SPECIES AND ENERGIES (MeV/nucleon)								
	H					Ti	Fe		Total
	250	500	1000	1200	2000	1000	600	1000	
Machine Set-Up	4:00:00	0:00:00	18:00:00	0:00:00	0:00:00	4:00:00	2:00:00	24:00:00	52:00
Wrap-Up	1:00:00	0:30:00	3:30:00	0:30:00	0:00:00	1:00:00	0:30:00	6:00:00	13:00
Non-Science									65:00
Sub-Total:									
Development	0:00:00	0:00:00	5:58:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	5:58
Biology									
In Vitro	14:54:47	5:59:37	24:28:57	3:36:24	2:16:40	7:08:19	0:00:00	51:48:14	110:13
In Vivo	0:00:00	0:00:00	14:33:53	0:00:00	0:00:00	0:00:00	0:00:00	9:33:28	24:07
Others	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:00:00	0:35:05	0:35
Physics	7:47:19	0:49:25	20:44:59	0:00:00	0:00:00	2:08:12	7:19:28	4:09:56	42:59
Science									
Sub Total:									177:55
RHIC Time Lost*	0:30:00	0:00:00	2:20:00	0:00:00	0:00:00	0:00:00	2:00:00	46:24:00	51:14
NSRL Time Lost	3:54:00	1:10:00	2:44:00	0:00:00	0:00:00	3:38:00	0:00:00	4:51:00	16:17
Totals	31:36	8:29	90:00	4:06	2:17	17:55	9:49	100:58	265:10

*Time lost due to RHIC filling and other RHIC-associated activities are reported, but do not contribute to the total hours

BEAM CHARACTERISTICS

Ion	H					Ti	Fe	
Energy (MeV/n)								
Planned	250	500	1000	1200	2000	1000	600	1000
Extracted	250	500	1000	1200	2000	1000	600	1000
On Target	250	500*	1000*	1200*	2000*	972	593	968
Fluence (particles/cm ² /sec)								
Maximum on target	1.13E+09	1.13E+09	1.13E+09	1.13E+08	1.13E+08	6.75E+06	7.50E+06	7.50E+06
Minimum on target	200	200	200	200	200	200	200	200
Spill Period (sec)	4	4	4	4	4	4	4	4
Spill rate (spills/min)	15	15	15	15	15	15	15	15
Spill length (msec)	300	300	300	300	300	300	300	300
Particles/spill								
Maximum	1.50E+11	1.50E+11	1.50E+11	1.50E+10	1.50E+10	9.00E+08	1.00E+09	1.00E+09
Minimum	200	200	200	200	200	200	200	200
Beam Cut Off Accuracy	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%
Actual LET on Target (keV/μm)	0.392*	0.276*	0.222*	0.210*	0.205*	108	174	151
Max. Dose Rate (Gy/min) 20 cm x 20 cm	0.0001	1	1	0.1	4	2	10	5
Total Dose (Gy)								
Maximum	N/A	50	7.2	N/A	5	2	20	100
Minimum	N/A	0.0001	0.0001	N/A	0.01	0.0001	0.1	0.0001

* No Bragg results are available for H running at 500 or 1000 MeV, or Fe at 300 MeV/nucleon. Only calculated LET is quoted.

DOSIMETRY AND BEAM DEVELOPMENTS

New Beams:

During NSRL 07B the following beams were developed and used for the first time:

Protons at 1200 MeV,

Protons at 2000 MeV.

RUN DATES

Ion	Energy	Scheduled Start	Scheduled End	Actual Start	Actual End
Protons	250-1000	5/22/07 7:00	5/30/07 16:00	5/22/07 7:00	5/30/07 21:56
Iron	600-1000	5/31/07 7:00	6/04/07 18:00	5/31/07 7:00	6/04/07 20:23
Protons	1000	6/05/07 7:00	6/05/07 16:00	6/05/07 7:00	6/05/07 19:54
Iron	1000	6/07/07 7:00	6/12/07 18:00	6/07/07 14:00	6/12/07 15:58
Protons	1000	6/13/07 7:00	6/13/07 20:00	6/13/07 8:00	6/13/07 17:30
Iron	1000	6/14/07 7:00	6/18/07 20:00	6/14/07 7:00	6/18/07 22:32
Protons	250-2000	6/19/07 7:00	6/21/07 19:00	6/19/07 7:00	6/21/07 24:21
Iron	1000	6/22/07 7:00	6/25/07 18:30	6/22/07 7:00	6/25/07 19:11
Protons	250-1000	6/26/07 7:00	6/27/07 18:00	6/26/07 7:00	6/27/07 14:05
Titanium	1000	6/28/07 7:00	6/29/07 18:00	6/28/07 7:00	6/29/07 13:20

Since energy changes have become routine, no set-up or wrap-up activities are performed when changing energy. During some days NSRL would deliver ions at several different energies. For this reason, the table of Run Dates is not broken down into entries for Ion and Energy, but has been grouped according to Ion only.

EXPERIMENTERS AND RUN STATISTICS

Proposal Number	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Range (cGray)	Dose Rate (cGy/minute)	Number of Samples
B-44	Durante, Marco	Iron	1000	4:00:00	4:24:57	7-200	20-100	200
B-44	Durante, Marco	Protons	1000	4:30:00	6:15:27	50-300	50	4
B-52	Gewirtz, Alan	Iron	1000	6:30:00	2:02:17	5-50	20-100	20
N-88	Sutherland, Betsy	Iron	1000	5:00:00	3:27:50	5-50	100	35
N-89	Held, Kathy	Iron	1000	7:00:00	4:45:49	.00001-200	.00001-200	70
N-89	Held, Kathy	Protons	1000	6:12:00	5:02:28	.00001-200	.00001-50	85
N-89	Held, Kathy	Titanium	1000	6:18:00	3:07:00	0.001-100	0.001-100	30
N-97	Kronenberg, Amy	Protons	1000	6:00:00	4:44:51	200-400	100	60
N-99	Zhao, Yongliang	Iron	1000	1:30:00	0:37:50	10-100	50	24
N-102	Hall, Eric	Iron	1000	2:12:00	0:00:00			
N-104	Ullrich, Robert	Protons	150	5:30:00	0:00:00			
N-120	Redpath, J.L.	Iron	1000	2:00:00	1:25:00	1-50	1-10	12
N-128	Blakely, Eleanor	Iron	1000	10:48:00	0:57:05	50-400	100	33
N-129	Limoli, Charles	Iron	1000	6:30:00	4:56:57	.00001-750	.00001-200	149
N-134	Chen, David	Iron	1000	1:30:00	3:44:25	25-100	100	86
N-134	Chen, David	Titanium	1000	1:30:00	0:52:54	50-200	100	28
N-135	Pluth, Janice	Iron	1000	8:00:00	7:19:16	5-500	10-100	170
N-145	O'Banion, M. Kerry	Iron	1000	6:33:00	5:09:06	600	100	126
N-154	Maurer, Richard	Iron	600	7:00:00	7:19:28	Low	Low	1
N-154	Maurer, Richard	Iron	1000	7:00:00	4:09:56	Low	Low	1
N-154	Maurer, Richard	Protons	1000	7:00:00	5:50:53	Low	Low	1
N-157	Schiestl, Robert	Iron	1000	3:00:00	0:00:00			
N-159	Hall, Eric	Iron	1000	5:30:00	0:50:30	25-150	25-100	12
N-160	Spence, Harlan	Protons	250	3:36:00	6:15:55	Low	Low	1
N-160	Spence, Harlan	Protons	500	4:48:00	0:49:25	Low	Low	1
N-160	Spence, Harlan	Protons	1000	3:36:00	5:44:26	Low	Low	1
N-167	Burma, Sandeep	Iron	1000	2:00:00	1:15:19	100-400	300	54
N-167	Burma, Sandeep	Protons	250	2:00:00	2:10:00	10-100	100	21
N-170	Wang, Ya	Iron	1000	6:00:00	4:41:30	20-500	100	128
N-172	Berkowitz, Dan	Iron	1000	1:30:00	0:51:03	100	50	20
N-175	Fike, John	Iron	600	2:00:00	0:00:00			
N-176	Cucinotta, Francis	Iron	1000	3:30:00	3:23:09	5-200	100	100

Proposal Number	Principle Investigator	Ion	Energy	Beam Time Approved	Beam Time Used	Dose Range (cGray)	Dose Rate (cGy/minute)	Number of Samples
N-176	Cucinotta, Francis	Protons	250	0:00:00	0:48:20	25-100	50-200	5
N-176	Cucinotta, Francis	Protons	1200	5:30:00	3:36:24	25-200	50-100	20
N-176	Cucinotta, Francis	Protons	2000	0:00:00	2:16:40	25-200	50-100	10
N-176	Cucinotta, Francis	Titanium	1000	3:30:00	3:08:25	5-500	10-100	20
N-177	Morgan, William	Iron	1000	6:00:00	4:41:29	5-100	10	130
N-185	Sutherland, Betsy	Protons	250	0:00:00	9:46:27	10-5000	20-999	42
N-185	Sutherland, Betsy	Protons	500	0:00:00	5:59:37	10-5000	10-40	24
N-185	Sutherland, Betsy	Protons	1000	3:00:00	5:29:03	1-30	20	24
N-185	Sutherland, Betsy	Iron	1000	3:00:00	0:00:00			0
N-186	Shay, Jerry	Iron	1000	2:00:00	0:51:57	50-150	100	6
N-186	Shay, Jerry	Protons	250	0:00:00	2:10:00	100-300	40	18
N-186	Shay, Jerry	Protons	1000	0:00:00	0:28:37	100-300	40	18
N-186	Shay, Jerry	Iron	600	2:00:00	0:00:00			0
N-189	Britt, Ann	Iron	1000	1:42:00	0:35:05	1250-2500	300	6
N-191	Wang, Huichen	Iron	1000	Piggyback				72
N-196	Azzam, Edouard	Iron	1000	1:54:00	2:12:30	10-200	50-100	42
N-196	Azzam, Edouard	Protons	1000	9:36:00	7:13:22	10-600	20-60	90
N-197	Fornace, Al	Iron	1000	3:00:00	1:44:02	10-200	10-100	15
N-199	Ware, Jeff	Protons	1000	6:00:00	9:49:02	50-680	40	240
N-199	Ware, Jeff	Iron	1000	1:30:00	1:59:41	50-400	100	70
E-2	Braby, Les	Titanium	1000	2:15:00	0:00:00			0
E-2	Braby, Les	Iron	600	2:15:00	0:00:00			0
E-2	Braby, Les	Iron	1000	2:15:00	0:00:00			0
E-4	Hassler, Donald	Protons	250	0:48:00	1:31:24	Low	Low	1
E-4	Hassler, Donald	Protons	1000	3:00:00	2:43:55	Low	Low	1
E-4	Hassler, Donald	Titanium	1000	2:00:00	2:08:12	Low	Low	1
E-6	Benton, Eric	Protons	1000	Piggyback				1
E-7	Jones, James	Protons	1000	6:00:00	6:25:45	30000	500	1

Entries in red indicate approved proposals there were not run during the 07B running period.

Total approved hours of science was 217:18.

Excluding the hours of those experimenters who did not run during NSRL Run 07B, the total hours approved for running was 192:51.

Total running hours of science was 177:55.